CLAIMS

1.   A printing method for printing an image on a medium, comprising the following steps:

5   printing a correction pattern based on a first gradation value by ejecting ink from a plurality of nozzles moving in a predetermined movement direction and forming a plurality of dot lines in an intersecting direction that intersects the movement direction;

obtaining, for each dot line, first information corresponding to 10   the first gradation value by measuring a darkness of the correction pattern dot line by dot line; and

printing an image constituted by a plurality of corrected dot lines on the medium by correcting each dot line in accordance with the first information and second information corresponding to a second gradation 15   value that is different from the first gradation value.

2.   A printing method according to claim 1, wherein a correction value is calculated for each dot line based on the first information and the second information; and

20   an image that is constituted by a plurality of the dot lines that have been corrected respectively in accordance with the correction value is printed on the medium.

3.   A printing method according to claim 2, 25   wherein a correction pattern based on the second gradation value is printed; and

the second information corresponding to the second gradation value is obtained for each dot line by measuring a darkness of this correction pattern dot line by dot line.

30

4.   A printing method according to claim 3, wherein the darkness of the correction pattern based on the first gradation value and the darkness of the correction pattern based on the second gradation value are measured dot line by dot line, and the 35   correction value is determined from the measurement value of each dot

line.

5.   A printing method according to claim 2,

wherein a plurality of the dot lines are formed in the intersecting direction through alternate repetition of a dot formation operation of forming dots on the medium by ejecting ink from the plurality of nozzles moving in the movement direction and a carrying operation of carrying the medium in the intersecting direction intersecting the movement direction.

6.   A printing method according to claim 5,

wherein a plurality of the nozzles are provided for each color of the ink;

the correction value is calculated for each color by printing the correction pattern in each color; and

the darkness of the image is corrected for each color in accordance with the correction value of each color.

7.   A printing method according to claim 3,

wherein a gradation value at which the darkness becomes a target value is determined by performing a linear interpolation using two information pairs, the two information pairs being a pair made up of the gradation value and the measurement value of one of the two correction patterns and a pair made up of the gradation value and the measurement value of the other of the two correction patterns; and

a value obtained by dividing a deviation between the determined gradation value and a reference gradation value corresponding to the target value by that reference gradation value is taken as the correction value.

8.   A printing method according to claim 7,

wherein the gradation value of one of the two information pairs is higher than the reference value and the gradation value of the other is smaller than the reference value.

9.   A printing method according to claim 7,

wherein the gradation value of one of the two information pairs is the same value as the reference value.

10.   A printing method according to claim 2,

wherein three information pairs are obtained, the three information pairs being a pair made up of the gradation value and a measurement value of one of three correction patterns that are each based on a different gradation value, a pair made up of the gradation value and a measurement value of another one of the three correction patterns, and a pair made up of the gradation value and a measurement value of yet another one of the three correction patterns;

if a darkness target value is higher than the second largest measurement value of the three information pairs, then a gradation value at which the darkness becomes the target value is determined by linear interpolation using the information including this second largest measurement value and the information including the measurement value higher than the second largest measurement value;

if the darkness target value is smaller than the second largest measurement value of the three information pairs, then the gradation value at which the darkness becomes the target value is determined by linear interpolation using the information including this second largest measurement value and the information including the measurement value smaller than the second largest measurement value; and

a value obtained by dividing a deviation between the determined gradation value and a reference gradation value corresponding to the target value by that reference gradation value is taken as the correction value.

11.   A printing method according to claim 10,

wherein the second largest gradation value is the same value as the reference value.

12.   A printing method according to claim 10,

wherein the target value is an average value of darkness measurement

values of all dot lines in the correction pattern based on the second gradation value of the three gradation values.

13. A printing method according to claim 7 or 10,
wherein the target value is a darkness measurement value of a darkness sample representing the darkness of the reference value.

14. A printing method according to claim 7 or 10,
wherein the reference value is selected from a darkness range of a middle-tone region.

15. A printing method according to claim 1,
wherein the darkness measurement value is a grey-scale measurement value.

16. A printing method according to claim 2,
wherein the image data for printing the image includes a gradation value for each dot formation unit formed on the medium;
if no correction value is associated with these formation units, then:

based on a creation ratio table associating the gradation values with the dot creation ratios, the creation ratio corresponding to the gradation value of the formation unit is read out; and

dots are formed in each formation unit on the medium in accordance with the creation ratio that has been read out; and
if the correction value is associated with these formation units, then:

when reading the creation ratio corresponding to a gradation value from the creation ratio table, the creation ratio corresponding to a value obtained by changing the gradation value by the correction value is read out; and

dots are formed in each formation unit on the medium in accordance with the creation ratio that has been read out.

17.   A printing method according to claim 16,

wherein the dot creation ratio indicates a proportion of a number of dots formed within a region that has a uniform gradation value and that is made of a predetermined number of the formation units, to that
5   predetermined number.

18.   A printing method according to claim 16,

wherein the nozzle can form dots of a plurality of sizes; and

in the creation ratio table, a relation between the creation ratios
10   and the gradation values is set for each size of dots.

19.   A printing method according to claim 1,

wherein the darkness of the correction pattern is measured using a darkness measuring device that measures darkness optically.
15

20.   A printing method according to claim 1,

wherein correction patterns are printed based respectively on specified gradation values including the first gradation value and the second gradation value, for each of the specified gradation values.
20

21.   A printing method according to claim 20,

wherein the first information is obtained by determining a new gradation value for forming a darkness corresponding to the first gradation value by performing a linear interpolation using information
25   in which the first gradation value and the measurement value of the correction pattern based on the first gradation value are associated and information in which a specified gradation value that is different from the first gradation value and a measurement value of the correction pattern based on that specified gradation value are associated, and associating
30   the determined new gradation value and the first gradation value; and

the second information is obtained by determining a new gradation value for forming a darkness corresponding to the second gradation value by performing a linear interpolation using information in which the second gradation value and a measurement value of the correction pattern based
35   on the second gradation value are associated and information in which

a specified gradation value that is different from the second gradation value and a measurement value of the correction pattern based on that specified gradation value are associated, and associating the determined new gradation value and the second gradation value.

5

22.   A printing method according to claim 1,

wherein correction patterns are printed based respectively on specified gradation values including the first gradation value, for each of the specified gradation values;

10   the first information is obtained by determining a new gradation value for forming a darkness corresponding to the first gradation value by performing a linear interpolation using information in which the first gradation value and the measurement value of the correction pattern based on the first gradation value are associated and information in which a

15   specified gradation value that is different from the first gradation value and a measurement value of the correction pattern based on that specified gradation value are associated, and associating the determined new gradation value and the first gradation value; and

the second information corresponds to the second gradation value

20   at which the printable gradation value becomes highest.

23.   A printing method according to claim 1,

wherein correction patterns are printed based respectively on specified gradation values including the first gradation value, for each

25   of the specified gradation values;

the first information is obtained by determining a new gradation value for forming a darkness corresponding to the first gradation value by performing a linear interpolation using information in which the first gradation value and the measurement value of the correction pattern based

30   on the first gradation value are associated and information in which a specified gradation value that is different from the first gradation value and a measurement value of the correction pattern based on that specified gradation value are associated, and associating the determined new gradation value and the first gradation value; and

35   the second information corresponds to the second gradation value

at which the printable gradation value becomes lowest.

24.   A printing method according to claim 21,

wherein the information in which the first gradation value and the
measurement value of the correction pattern based on the first gradation
value are associated, information in which a specified gradation value
that is higher than the first gradation value and a measurement value
of the correction pattern based on this specified gradation value are
associated, and information in which a specified gradation value that
is lower than the first gradation value and a measurement value of the
correction pattern based on this specified gradation value are associated
are obtained;

if the darkness corresponding to the first gradation value is higher
than the measurement value of the correction pattern based on the first
gradation value, then a linear interpolation is performed using the
information in which the first gradation value and the measurement value
of the correction pattern based on the first gradation value are associated,
and the information in which the specified gradation value that is higher
than the first gradation value and the measurement value of the correction
pattern based on this specified gradation value are associated;

if the darkness corresponding to the first gradation value is
smaller than the measurement value of the correction pattern based on
the first gradation value, then a linear interpolation is performed using
the information in which the first gradation value and the measurement
value of the correction pattern based on the first gradation value are
associated, and the information in which the specified gradation value
that is lower than the first gradation value and the measurement value
of the correction pattern based on this specified gradation value are
associated; and

a new gradation value for forming the darkness corresponding to
the first gradation value is determined.

25.   A printing method according to claim 24,

wherein an average value of the darkness of each dot line
constituting the correction pattern based on the first gradation value

is taken as the darkness corresponding to the first gradation value.

26.   A printing method according to claim 24,
wherein a darkness measurement value of a darkness sample is taken
as the darkness corresponding to the first gradation value.

27.   A printing method according to claim 1,
wherein the image data for printing the image includes a gradation
value for each dot formation unit formed on the medium; and
the darkness of each of the dot lines is corrected by correcting
the gradation value of each of the formation units.

28.   A printing method according to claim 1,
wherein a new gradation value for forming a darkness corresponding
to a gradation value other than the first gradation value and the second
gradation value is determined by linear interpolation of the first
information and the second information.

29.   A printing method according to claim 1,
wherein a dot creation ratio for a gradation value is corrected
based on the first information and the second information.

30.   A printing method according to claim 29,
wherein a dot creation ratio for a gradation value other than the
first gradation value and the second gradation value is determined by
linear interpolation of a dot creation ratio of the first gradation value
and a dot creation ratio of the second gradation value.

31.   A printing method according to claim 1,
wherein a plurality of the nozzles are provided for each color of
the ink;
the first information is obtained for each color by printing the
correction pattern based on the first information in each color; and
each dot line is corrected, color by color, in accordance with the
first information and the second information.

32.   A printing method for printing an image on a medium, comprising the following steps:

printing a correction pattern based on a first gradation value and

5   a correction pattern based on a second gradation value different from the first gradation value by ejecting ink from a plurality of nozzles moving in a predetermined movement direction and forming a plurality of dot lines in an intersecting direction that intersects the movement direction;

10   obtaining, for each dot line, first information corresponding to the first gradation value and second information corresponding to the second gradation value by measuring a darkness of the correction pattern dot line by dot line;

wherein a correction value is calculated for each dot line based

15   on the first information and the second information; and

an image that is constituted by a plurality of the dot lines that have been corrected respectively in accordance with the correction value is printed on the medium;

wherein:

20   a plurality of the dot lines are formed in the intersecting direction through alternate repetition of a dot formation operation of forming dots on the medium by ejecting ink from the plurality of nozzles moving in the movement direction and a carrying operation of carrying the medium in the intersecting direction intersecting the movement

25   direction;

a plurality of the nozzles are provided for each color of the ink;

the correction value is calculated for each color by printing the correction pattern in each color; and

the darkness of the image is corrected for each color in accordance

30   with the correction value of each color;

three information pairs are obtained, the three information pairs being a pair made up of the gradation value and a measurement value of one of three correction patterns that are each based on a different gradation value, a pair made up of the gradation value and a measurement

35   value of another one of the three correction patterns, and a pair made

up of the gradation value and a measurement value of yet another one of the three correction patterns;

if a darkness target value is higher than the second largest measurement value of the three information pairs, then a gradation value at which the darkness becomes the target value is determined by linear interpolation using the information including this second largest measurement value and the information including the measurement value higher than the second largest measurement value;

if the darkness target value is smaller than the second largest measurement value of the three information pairs, then the gradation value at which the darkness becomes the target value is determined by linear interpolation using the information including this second largest measurement value and the information including the measurement value smaller than the second largest measurement value; and

a value obtained by dividing a deviation between the determined gradation value and a reference gradation value corresponding to the target value by that reference gradation value is taken as the correction value;

the second largest gradation value is the same value as the reference value;

the target value is an average value of darkness measurement values of all dot lines in the correction pattern based on the second gradation value of the three gradation values;

the target value is a darkness measurement value of a darkness sample representing the darkness of the reference value;

the reference value is selected from a darkness range of a middle-tone region;

the darkness measurement value is a grey-scale measurement value;

the image data for printing the image includes a gradation value for each dot formation unit formed on the medium;

if no correction value is associated with these formation units, then:

based on a creation ratio table associating the gradation values with the dot creation ratios, the creation ratio corresponding to the gradation value of the formation unit is read out; and

dots are formed in each formation unit on the medium in accordance with the creation ratio that has been read out; and

if the correction value is associated with these formation units, then:

5   when reading the creation ratio corresponding to a gradation value from the creation ratio table, the creation ratio corresponding to a value obtained by changing the gradation value by the correction value is read out; and

dots are formed in each formation unit on the medium in

10   accordance with the creation ratio that has been read out;

the dot creation ratio indicates a proportion of a number of dots formed within a region that has a uniform gradation value and that is made of a predetermined number of the formation units, to that predetermined number;

15   the nozzle can form dots of a plurality of sizes; and

in the creation ratio table, a relation between the creation ratios and the gradation values is set for each size of dots; and

the darkness of the correction pattern is measured using a darkness measuring device that measures darkness optically.

20

33.   A printing method for printing an image on a medium, comprising the following steps:

printing a correction pattern based on a first gradation value by ejecting ink from a plurality of nozzles moving in a predetermined movement

25   direction and forming a plurality of dot lines in an intersecting direction that intersects the movement direction;

obtaining, for each dot line, first information corresponding to the first gradation value by measuring a darkness of the correction pattern dot line by dot line; and

30   printing an image constituted by a plurality of corrected dot lines on the medium by correcting each dot line in accordance with the first information and second information corresponding to a second gradation value that is different from the first gradation value;

wherein:

35   correction patterns are printed based respectively on specified

gradation values including the first gradation value, for each of the specified gradation values;

the first information is obtained by determining a new gradation value for forming a darkness corresponding to the first gradation value by performing a linear interpolation using information in which the first gradation value and the measurement value of the correction pattern based on the first gradation value are associated and information in which a specified gradation value that is different from the first gradation value and a measurement value of the correction pattern based on that specified gradation value are associated, and associating the determined new gradation value and the first gradation value; and

the second information corresponds to the second gradation value at which the printable gradation value becomes highest or lowest;

the information in which the first gradation value and the measurement value of the correction pattern based on the first gradation value are associated, information in which a specified gradation value that is higher than the first gradation value and a measurement value of the correction pattern based on this specified gradation value are associated, and information in which a specified gradation value that is lower than the first gradation value and a measurement value of the correction pattern based on this specified gradation value are associated are obtained;

if the darkness corresponding to the first gradation value is higher than the measurement value of the correction pattern based on the first gradation value, then a linear interpolation is performed using the information in which the first gradation value and the measurement value of the correction pattern based on the first gradation value are associated, and the information in which the specified gradation value that is higher than the first gradation value and the measurement value of the correction pattern based on this specified gradation value are associated;

if the darkness corresponding to the first gradation value is smaller than the measurement value of the correction pattern based on the first gradation value, then a linear interpolation is performed using the information in which the first gradation value and the measurement value of the correction pattern based on the first gradation value are

associated, and the information in which the specified gradation value that is lower than the first gradation value and the measurement value of the correction pattern based on this specified gradation value are associated, and

5   a new gradation value for forming the darkness corresponding to the first gradation value is determined;

an average value of the darkness of each dot line constituting the correction pattern based on the first gradation value is taken as the darkness corresponding to the first gradation value;

10   the image data for printing the image includes a gradation value for each dot formation unit formed on the medium; and

the darkness of each of the dot lines is corrected by correcting the gradation value of each of the formation units;

a new gradation value for forming a darkness corresponding to a

15 gradation value other than the first gradation value and the second gradation value is determined by linear interpolation of the first information and the second information;

a dot creation ratio for a gradation value is corrected based on the first information and the second information;

20   a dot creation ratio for a gradation value other than the first gradation value and the second gradation value is determined by linear interpolation of a dot creation ratio of the first gradation value and a dot creation ratio of the second gradation value;

a plurality of the nozzles are provided for each color of the ink;

25   the first information is obtained for each color by printing the correction pattern based on the first information in each color; and

each dot line is corrected, color by color, in accordance with the first information and the second information.

30 34.   A printing system for printing an image on a medium, comprising:

a plurality of nozzles moving in a predetermined movement direction; and

a controller, the controller:

printing a correction pattern based on a first gradation

35 value by ejecting ink from the plurality of moving nozzles and forming

a plurality of dot lines in an intersecting direction that intersects the movement direction;

obtaining, for each dot line, first information corresponding to the first gradation value by measuring a darkness of the correction pattern dot line by dot line; and

printing an image constituted by a plurality of corrected dot lines on the medium by correcting each dot line in accordance with the first information and second information corresponding to a second gradation value that is different from the first gradation value.